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Research Paper

Development and organoleptic evaluation of ashwagandha (*Withania somnifera*) based value added product and its effect on anthropometric parameters of underweight adolescent girls

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ABSTRACT : The present study was conducted to standardize and develop a value added product from ashwagandha and to assess its clinical effect on anthropometric parameters of underweight due to its good therapeutic value. Three types of ashwagandha biscuits were prepared *viz.*, by the incorporation of ashwagandha root powder, ashwagandha leaf powder and ashwagandha root+leaf powder. The sensory evaluation of the biscuits showed that they were liked by the panel of judges. The products prepared by the incorporation of ashwagandha root powder were acceptable in comparison to the products prepared by the incorporation of ashwagandha leaf powder but from medicinal point of view, they were acceptable. The product was studied for shelf-life and the sensory evaluation was done on 10th day, 20th day and 30th day of storage period over 30 days. The results showed that there was a slight change in the sensory attributes during the storage period. The clinical effect of ashwagandha root powder biscuit was undertaken on 10 underweight adolescent girls chosen from Smt. Indramani Mandelia Shiksha Niketan, Town Pilani, Rajasthan. The initial weight and the BMI of the test group with mean values of 39.70 and 16.66 increased significantly to a mean of 41.90 and 17.59 finally over a period of 1 month, respectively no significant change was observed in the weights and BMI of the control group. Thus, proving that ashwagandha is efficient in increasing the weight of those who are underweight.

KEY WORDS : Underweight, Anthropometric parameters, Underweight, Ashwagandha

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Undernutrition is still prevalent in developing countries and continues to be a primary cause of poor health (Sawaya *et al.*, 2004). Adolescents underweight has been identified as a risk factor for underweight in adulthood and it leads to a variety of adverse health outcomes and low birth weight in babies (Cole *et al.*, 2000). Being underweight can also derail the intake and absorption of vital nutrients, including amino acids, vitamins and minerals, leading to an increased risk of osteoporosis and anaemia. In addition, underweight women are prone to amenorrhea and possible pregnancy complications, emotional disorders, delayed onset of puberty and increased susceptibility to infection. The term underweight refers to a human who is considered to be under a healthy weight. The definition is usually made with reference to the body mass index (BMI). A BMI of under 18.5 is usually referred to as underweight. Underweight in adolescent girls is common due to psychosocial, emotional, gender based discrimination thus leading to low food intake and resulting symptoms like amenorrhea, osteoporosis, fatigue, low body weight. Another major psychological cause of underweight is depression. Individuals suffering from depression often have reduced appetite and rapid weight loss. Medicinal plants have been widely used for treatment of various human ailments in all cultures throughout history.

Ashwagandha (*Withania somnifera*) or Indian winter cherry is an important ancient medicinal plant of the Solanaceae family, the roots of which have been employed in Indian traditional systems of medicine, Ayurveda and Unani.

Ashwagandha is also known as Indian ginseng since its active ingredients withanolides are similar to ginsenosides of Asian ginseng. It is bitter in taste. Ashwagandha is a well known anti-stress herb. The active components in ashwagandha or *Withania somnifera* are steroidal lactones (withanolides) and alkaloids. Withanolides are generally defined as steroids with an ergostane skeleton and lactone ring. These constituents are important hormone precursors, which the body can convert into human hormones. Alkaloids can work as analgesics, antispasmodics, anti-hypertensives and can alleviate central nervous system disorders. Ashwagandha increases R.B.C levels, enhances immune system and increases W.B.C which are all risk factors in underweight. Administration of an extract from the powdered root of the plant, *Withania somnifera* was found to stimulate immunological activity in mice by increasing total WBC count, bone marrow cellularity, alpha/?esterase positive cell number, phagocytic activity of peritoneal macrophages (Davis and Kuttan, 2000). Ashwagandha is widely used in any debility, emaciation or consumptive condition, in both adults and children (Kirtikar and Basu, 1993). Ashwagandha exhibits a variety of therapeutic effects with little or no associated toxicity (Mishra *et al.*, 2000).

Keeping in view the relevance of ashwagandha as a valuable herb which has a myriad of benefits but its bitter taste which makes it least acceptable in raw form, the present study was designed with the objective to develop and evaluate a value added food product of ashwagandha for its sensory characteristics and shelf-life using 9 point hedonic scale and to assess the impact of ashwagandha root powder on anthropometric parameters of underweight adolescent girls.

■ RESEARCH METHODS

The plan of work has been materialized with following material and methods:

Procurement of material :

Ashwagandha plant was procured from Birla Yog Naturopathy Kendra, Pilani. The leaves and the roots were plucked out from the plants. These were washed with water to remove the dirt, soil and foreign matter. Then these were dried in sunlight. At last dried ashwagandha leaves and ashwagandha roots were powdered separately in the grinding machine.

Development of value added product :

Three types of ashwagandha biscuit were standardized and developed *viz.*,ashwagandha leaf powder biscuit, ashwagandha root powder biscuit and both ashwagandha leaf+root powder biscuit. Secondly, refined wheat flour biscuit were prepared for control group. Sensory evaluation of the products was done using 9 point hedonic scale. The ingredients used for the preparation of ashwagandha biscuit are listed in Table A.

Procedure :

- Refined wheat flour and ashwagandha powder was sifted together 3-4 times with a sieve.
- White butter was melted in a pan.
- Sugar was added to it and it was mixed well.
- Milk was added to it so that it gets mixed well.
- The sieved refined wheat flour and ashwagandha powder was added to it and the mixture was knead into dough.
- The dough was then shaped into biscuits.
- The biscuits were then baked in oven on 200^0 C for 2 minutes.

The ingredients and recipe of refined wheat flour biscuit was same but did not contained ashwagandha.

Shelf-life studies :

To determine the shelf-life of the product, its sensory evaluation was conducted at an interval of 10 days over a period of 30 days using the 9 point hedonic scale.

Selection of the subjects :

20 participants were chosen from girls' college Smt. Indramani Mandelia Shiksha Niket, Pilani (Rajasthan) from the 3 faculties of undergraduate *viz.*, Arts, Science, Home Science and 2 Departments of postgraduate *i.e.*, M.Sc. Foods and Nutrition and M.Sc. IT. Participants were chosen on the basis of anthropometric assessment.

Table A: Ingredients for ashwagandha biscuits

Ingredients	I Ashwagandha root powder biscuit	II Ashwagandha leaf powder biscuit	III Ashwagandha root+ leaf powder biscuit
Refined wheat flour (g)	100	100	100
Sugar (g)	60	60	60
Ghee (g)	60	60	60
Milk (ml)	60	60	60
Ashwagandha root powder (g)	5	–	–
Ashwagandha leaf powder (g)	–	5	–
Ashwagandha (root+leaf) powder (g)	–	–	2.5 +2.5

The ingredients are given for 10 biscuits each weighing 10 g

Anthropometric parameters :

Body measurements such as height, weight and body mass index which were simple and easy to measure and provide maximum information of the nutritional status were chosen for the study according to the method given by Jelliffe (1986). Anthropometric parameters were measured both before and after experimental period.

Feeding of the subjects :

The selected girls were divided into two groups *i.e.* the control group and the test group.

Control group:

The control group consisted of 10 girls among the 20 samples selected and was served four refined wheat flour biscuits each day *i.e.* two biscuits early in the morning and two in the afternoon. Each biscuit weighed 10 g.

Test group :

The test group consisted of 10 girls among the 20 samples selected and was served ashwagandha root powder biscuits. Each biscuit weighed 10 g and contained about 0.5 g. ashwagandha powder. These were given to the subjects daily for 30 days. The amount of biscuits given were four in number which were to be eaten two times a day *i.e*. two biscuits early in the morning and two in the evening.

The duration of the study was 30 days. No dietary modifications were made.

Statistical analysis:

The data obtained were analyzed statistically using mean and t-test.

■ RESEARCH FINDINGS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Sensory evaluation of ashwagandha biscuits :

Table 1 indicates that all type of ashwagandha biscuits were acceptable especially biscuit prepared by the incorporation of ashwagandha root powder. The scores of colour and appearance of ashwagandha root powder biscuit was 'liked extremely and the flavour and taste was 'liked very much' and the texture and overall acceptability was 'liked moderately' by the panel of judges. In comparison to ashwagandha root powder biscuit,the scores of ashwagandha leaf powder biscuit differed slightly. Ashwagandha leaf powder biscuit was 'liked moderately' and 'liked slightly' by the judges. The scores of the ashwagandha root+leaf powder biscuit revealed that the colour, appearance and texture was 'liked moderately' and the flavour, taste and overall acceptability was 'liked slightly' by the judges.

Shelf-life studies :

Table 2 shows that there were not much alterations in the organoleptic characteristics of ashwagandha biscuits during the storage period of 30 days. The scores of colour, appearance and texture were desirable throughout the study period with a slight change in colour.

However, by reaching the end period of storage, there was a reduction in appearance and texture of the biscuits. Time of storage affected the flavour and taste of the biscuits. Deterioration in the flavour of the biscuits occurred during subsequent storage. The overall acceptability of the product from medicinal point of view was not much affected.

Clinical effect of ashwagandha biscuits on weight of underweight adolescent girls :

Amongst the total 20 girls selected for the study, in between the age group of 17-18years, 60 per cent (12) girls were in between 17-18 years of age and 4 per cent (8) girls were in between 18-19 years of age.

Fig. 1 represents that there was no change in the weight of the subjects of the control group except one subject whereas there was a noticeable change in the weight of the test group except two subjects.

The data in Fig. 2 reveal that there was no change in the BMI of the control group except one subject whereas a remarkable change was observed in the BMI of the test group except two subjects.

The result of the pre and post-changes in means of weight and BMI of the control group were found to be non-significant. Thus, indicating that refined wheat flour biscuit did not has any effect on weight and BMI of underweight girls (Table 3).

Table 4 shows that a highly significant increase in the means of weight and BMI of the test group was observed at $P<0.01$ level after supplementation of ashwagandha biscuits. Thus, proving that the gain in weight of the test group was not due to the consumption of simple refined wheat flour biscuits but due to ashwagandha.

Table 1 : Mean sensory scores for freshly prepared ashwagandha biscuits

Sr. No.	Treatment/ combination	Colour	Appearance	Flavour	Texture	Taste	Overall acceptability
I	Ashwagandha root powder	9.40	9.30	7.20	8.60	7.50	8.40
II	Ashwagandha leaf powder	7.45	7.40	6.20	7.20	6.30	6.20
III	Ashwagandha root + leaf powder	7.60	7.65	6.30	7.30	6.40	6.30

Values are mean of 10 independent observations

Hence, it can be said that ashwagandha is effective in increasing the weight of those who are underweight. Consumption of ashwagandha showed relief of symptoms like loss of apetite, general debility and weight gain in underweight patients with significant increase in I_gA, I_gG, and I_gM levels suggesting its immuno-potentiation (Chudasama and Singh, 1986).

Table 2 : Effect of storage on sensory quality of ashwagandha biscuits at different intervals of storage

Storage period	I Ashwagandha root powder biscuit	II Ashwagandha leaf powder biscuit	III Ashwagandha root + leaf powder biscuit
Colour			
10th day	9.25	7.30	7.50
20th day	9.10	7.25	7.30
30th day	8.85	7.20	7.20
Mean	9.06	7.25	7.3
Appearance			
10th day	9.20	7.25	7.50
20th day	9.10	7.20	7.45
30th day	8.70	6.85	6.90
Mean	9	7.1	7.3
Flavour			
10th day	7.10	6.15	6.20
20th day	6.80	6.10	6.15
30th day	6.70	5.95	5.90
Mean	6.9	6.06	6.08
Texture			
10th day	8.45	7.10	7.15
20th day	8.30	7.00	7.10
30th day	7.90	6.80	6.85
Mean	8.2	6.9	7.03
Taste			
10th day	7.45	6.25	6.30
20th day	7.40	6.10	6.15
30th day	6.85	5.55	5.90
Mean	7.2	5.96	6.11
Overall acceptability			
10th day	8.20	6.15	6.25
20th day	8.15	6.10	6.17
30th day	8.00	6.00	6.10
Mean	8.11	6.08	6.17

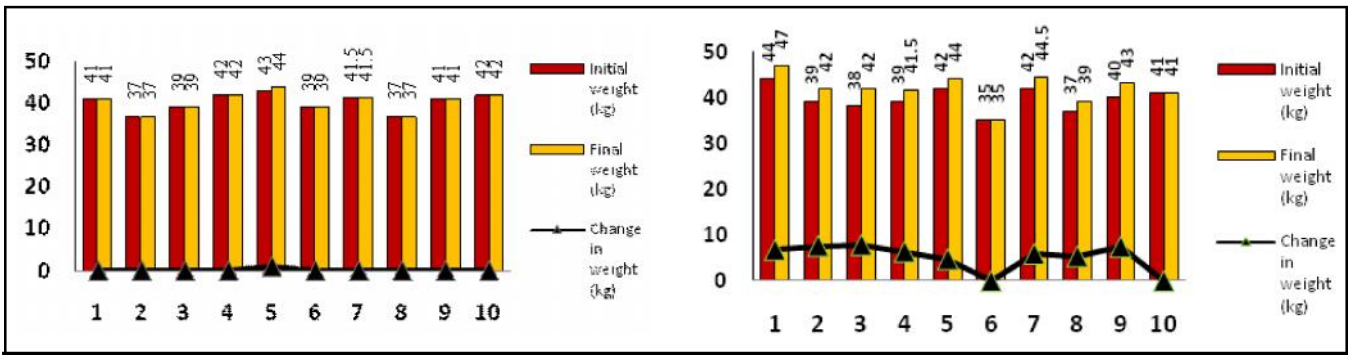

Fig. 1 : Comparison between effect of refined wheat flour biscuits and ashwagandha biscuit on weight of underweight adolescent girls

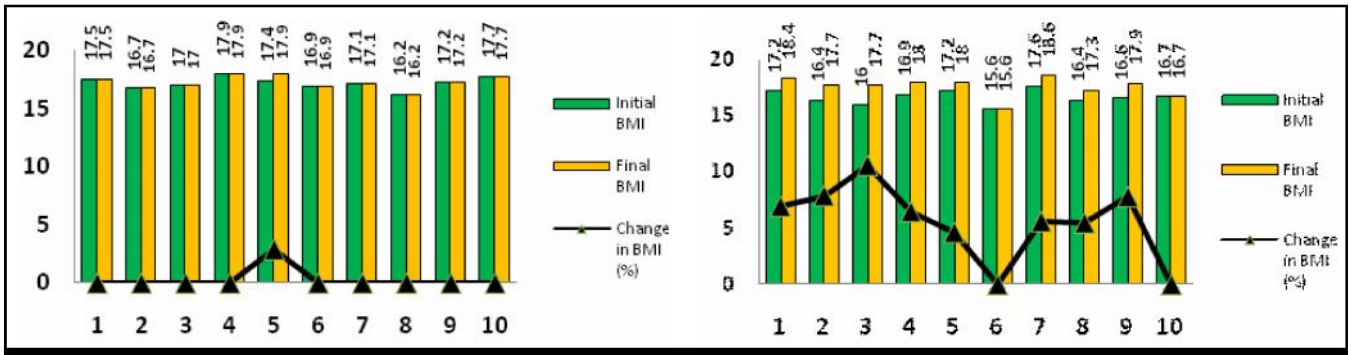

Fig. 2 : Comparison between effect of refined wheat flour biscuits and ashwagandha biscuit on BMI of underweight adolescent girls

Table 3 : Comparison of means of weight and BMI of the control group both at the start of the study and at the end of the study

Variable	Mean ± SD		't' Value
	Pre	Post	
Weight	40.25 ± 2.124	40.35 ± 2.832	0.4961 NS
BMI	17.16 ± 0.499	17.21 ± 0.548	0.3434 NS

***** and ** Indicate significance of value at P=0.05 and 0.01, respectively, NS=Non - significant

Table 4 : Comparison of means of weight and BMI of the test group before and after supplementation of ashwagandha biscuits

Variable	Mean ± SD		't' Value
	Pre	Post	
Weight	39.70 ± 2.668	41.90 ± 3.255	0.0004**
BMI	16.66 ± 0.598	17.59 ± 0.879	0.0005**

***** and ** Indicate significance of value at P=0.05 and 0.01, respectively, NS=Non - significant

Conclusion :

From the present study, it was concluded that the value added ashwagandha biscuit prepared by the incorporation of ashwagandha root powder, ashwagandha leaf powder and ashwagandha root+leaf powder were liked on the 9 point hedonic scale. The biscuit prepared by the incorporation of ashwagandha leaf powder was not much acceptable than that prepared by the incorporation of ashwagandha root powder. This might be due to the bitterness of leaves. But from medicinal point of view, they were acceptable. There was a slight change in the sensory parameters on storage of 30 days. The increase in weight and BMI of the test group reveals that the increase is not due to the consumption of refined wheat flour biscuit but is due to the consumption of ashwagandha root powder.

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